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(54) **Use of silicone for manufacturing confectionery moulds and baking receptacles in general**

Verwendung von Siliconverbindungen zur Herstellung von Konditorwarenformen und Backblech

Emploi de silicone pour la fabrication de moules en confiserie et de récipient de cuisson

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**EP 0 992 195 B1**

## Description

[0001] The present invention relates to the use of silicon for the manufacturing of confectionery moulds and baking receptacles in general.

## BACKGROUND OF THE INVENTION

[0002] Silicone is a material of polymeric nature whose chains are made up of alternating oxygen and silicon atoms. Silicones are normally prepared by hydrolysis and subsequent polymerisation of alkylhalogensilanes (both acid- and base-catalysed). The alkylhalogensilanes are in practice made by a direct process, Cu-catalysed, in which the Si reacts with the corresponding alkyl halide. This process provides mixtures of products, whose composition can be modified by a process of redistribution to yield the desired monomer.

[0003] Known in the art are silicone elastomers, which are made up of linear polymers. A cross-linking phase is required in order to provide the elastic properties. The most common elastomers are those deriving from dichloromethylsilane, with molecular weights ranging between 300,000 and 700,000. They are made by a prepolymerisation that provides octamethylcyclotetrasiloxane, purification thereof and subsequent polymerisation in the presence of a small quantity of monofunctional material in order to control the molecular weight, followed by a cross-linking similar to curing, in the presence of peroxides, which lends the material its elastic properties. Other important elastomers are those that contain a small proportion (0.1% molar) of vinyl groups linked to silicon, which undergo much more effective curing, and those that contain between 10 and 15% molar of phenyl groups, and good elastic properties at low temperatures. Elastomers of a much lower molecular weight (10,000 to 100,000) can be obtained by using linear polymer chains ending in silanol groups, which can be cured at room temperature by reaction with an alkoxyane.

[0004] In general, the most important characteristic of the silicone elastomers is the fact that they present a very broad thermal spectrum of use (from -50°C to 200°C) without a significant alteration of their properties. They have good electrical insulation properties, do not self-oxidise or undergo attack by chemical agents in aqueous medium and swell in the presence of non-polar organic solvents, although some special types that contain fluoro- or cyano- groups offer greater resistance to this process.

[0005] Silicone elastomers find their widest industrial application as electrical insulators, fluid-repellents and oxidation protectors, and in the manufacturing of hermetic gaskets. The silicones are highly inert materials, and they repel water. Silicone is inert to chemical agents, with the exception of strong bases and acids, and its toxicity is generally low. The origin of these properties lies essentially in the high stability of the Si-O bond (106 Kcal/mol), and in its strong partial ionic character.

[0006] Other known uses of silicones are in the manufacturing of containers for liquids (such as wineskins) and tubes for transporting substances (such as the tubes used for blood transfusions).

[0007] The use of silicone for manufacturing confectionery moulds is well known.

[0008] JP-A-02009344 refers to a chocolate candy of floral pattern prepared using a shaping mould having high stretchability, elasticity and suitable shape-holding property. The mould is from an elastic material such as natural rubber, silicone rubber or urethane rubber.

[0009] GB-A-2 254 036 refers to a casting food composition into a continuous flexible mould. The method comprises feeding the mobile composition to the mould, which extends continuously around a vertical or horizontal endless path and allowing the composition to set within the mould, preferably by cooling it in an air cooled tunnel. The mould is preferably of silicone or neoprene rubber.

## DESCRIPTION OF THE INVENTION

[0010] The present invention is aimed at the use of silicone obtained by a process of crosslinking with platinum for the manufacturing of confectionery moulds and baking receptacles in general.

[0011] The use of silicone for manufacturing confectionery moulds presents many advantages over use of the conventional materials applied in the known confectionery moulds.

[0012] The known moulds are generally manufactured in aluminium, clay or fibreglass. Use of such materials has the disadvantage that, because they are rigid moulds, the mould-removal operation is difficult. Certain types of moulds manufactured in aluminium have had to have their structural complexity increased in order to incorporate a mould-removal system that comprises means of opening of the side wall of the mould in order to take the food out once cooked. Aluminium moulds are thus known whose side wall is articulated so that it can be opened suitably in order to remove the food once cooked. Said moulds have means for locking the side wall in order to keep the side wall closed so that the food retains its shape during cooking.

[0013] The use of silicone to manufacture the confectionery moulds and baking receptacles in general of the invention solves the disadvantages of the confectionery moulds and baking receptacles in the prior art. As will become clear

below, the use of the present invention offers many other advantages which will be set out below.

[0014] The present invention is based on use of a heat-curable elastomer for the manufacturing of confectionery moulds and baking receptacles in general. This heat-curable elastomer is of the type intended for applications involving contact with food. The use of silicone has interesting features that afford many advantages, which are set out below.

[0015] Firstly, thanks to the characteristic properties of silicone, the operation of removing a product from the mould is very simple owing to the elasticity that the silicone confers upon the mould or baking receptacle. Users can thus effectively handle said mould or baking receptacle in order to remove the food product from the mould, in the secure knowledge that the mould will recover its initial shape. The characteristics of the silicone provide considerable flexibility of shapes from a constructive viewpoint, so that the moulds and receptacles can be made in any shape and size to suit user requirements.

[0016] Secondly, the heat resistance of the silicone used in the present invention provides highly versatile moulds and baking receptacles, since they can be used in conventional ovens, microwave ovens, and even in freezers. The good physical and chemical stability of the silicone used provides a wide thermal spectrum of use (-40°C to 200°C) and very good resistance to thermal ageing and to oxidizing agents (oxygen, ozone, UV).

[0017] Thirdly, the low adherence offered by the silicone surfaces makes moulds and baking receptacles manufactured with the silicone of the invention highly suited to the purposes described.

[0018] Fourthly, the above-mentioned flexibility of the heat-curable elastomer of the type destined for applications in contact with foods of the present invention provides moulds and baking receptacles that can be stored taking up a minimum space. It should be noted that the flexibility of the silicone used is mainly due to the wide angle of the Si-O-Si bond and to the large distance between the Si and O atoms, together with the absence of substituents on the O atom.

[0019] Fifthly, special emphasis should also be placed on the fact that the elastomer in question does not retain much heat. This is important in practice, since it prevents users from burning their hands when handling the mould or receptacle in question.

[0020] In accordance with a first aspect of the invention, the silicone used is of the methyl-vinyl-polysiloxane (VMQ) type.

[0021] The inorganic character of the Si-O-Si chain of the methyl-vinyl-polysiloxane provides an innocuous product and, therefore, one suitable for use with food. It should also be borne in mind that methyl-vinyl-polysiloxane (VMQ) does not alter the taste of foods, while it further has a low concentration of volatile substances, which has a positive influence on the post-curing process of the silicone mould, as will be described below.

[0022] The nature of the polymer provides exceptional mechanical characteristics, as shown in the table below.

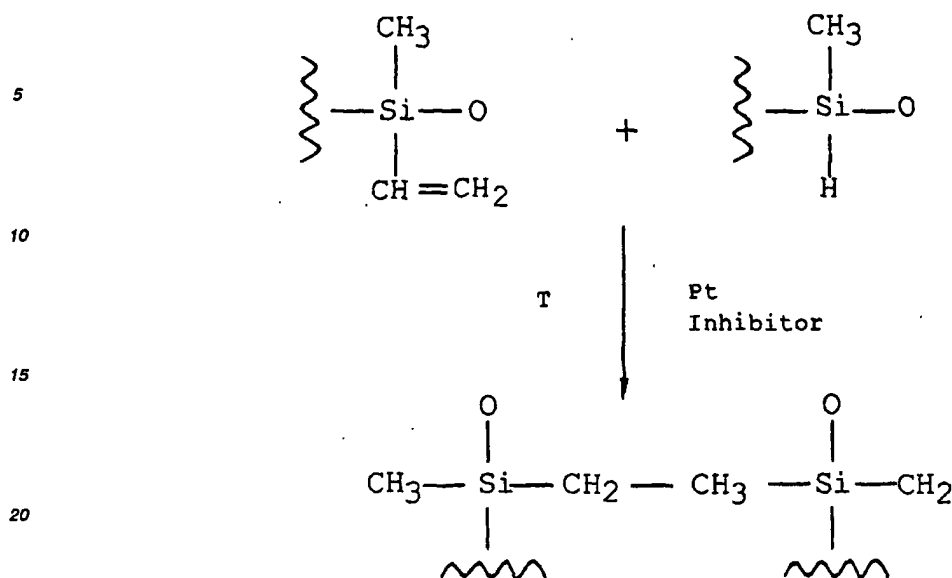
Property	Value
Hardness	55 Sh A
Breaking strength	9 Mpa
Elongation	450%
Tear resistance	30 N/mm

[0023] Silicone of the methyl-vinyl-polysiloxane type is fully biocompatible, since it shows no bacterial adhesion due to its capacity for constructing non-polar surfaces which develop minimum interaction with biological systems.

[0024] A mould and/or baking receptacle is thus provided that can be washed easily. In this respect, it should be noted that said mould or receptacle can be washed in a dishwasher.

[0025] All the advantages mentioned above lead to the conclusion that this is a highly advantageous material for use in contact with foodstuffs. For that purpose, and owing to the low concentration of volatile substances, as mentioned above, a short post-curing process is sufficient in order to comply with current legislation on products in contact with foodstuffs.

[0026] In accordance with the present invention, the silicone is obtained by a cross-linking process with platinum, as illustrated below.



25 **[0027]** The foregoing formulation illustrates the general schema of a cross-linking reaction by Pt. Thanks to said process the polyaddition reaction takes place much more quickly than reactions initiated by organic peroxides. On the other hand, the use of platinum as a catalyst of the polymerisation process does not generate decomposition by-products. As a consequence, it can be stated that this process does not produce toxic peroxide residues or odours in the cross-linked products. Advantageously, neither are any compounds produced that could alter the taste of foods.

30 For this reason, the type of silicone chosen is totally compatible with the use described in this specification.

**[0028]** A mould or baking receptacle manufactured in accordance with the present invention is preferably manufactured by moulding the pieces in chromium-plated moulds at a temperature of 190 to 200°C for 3 minutes. Once the piece has been moulded, the post-curing operation is carried out in order to sterilise the piece. Said post-curing operation consists in placing the piece in a hot-air oven or forced-circulation oven at a maximum temperature of about 200°C for 5 hours. Once post-cured, the mould is placed for half an hour in an industrial washer and dryer in order to purify the piece.

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**[0029]** The invention relates to the use of silicone for confectionery moulds and other baking receptacles in general, independently of the shape and dimensions thereof or the accessory details that might arise. It will thus be obvious to an expert in the subject that silicones with organic colorants (suitable for contact with foodstuffs) can be used. As a result, said shapes, dimensions and accessory details may be suitably replaced by others that are technically equivalent, as long as they do not depart from the essential nature of the object of the present invention or from the scope of protection defined by the appended claims.

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#### 45 Claims

1. Use of silicone obtained by a process of crosslinking with platinum for the manufacturing of confectionery moulds and baking receptacles in general.
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#### Patentansprüche

1. Anwendung von Silikon, durch einen Platilvernetzungsprozeß gewonnen, für das Herstellen von Gußformen für die Süßwarenindustrie und von Bäckereirezipienten im allgemeinen.
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**Résumé**

1. Utilisation de silicone obtenue par un procédé de réticulation avec platine pour la fabrication de moules de pâtisserie et de récipients de cuisson en général.

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